moisture around the engagement plane, the working end can more effectively apply energy to the tissue—and provide a deeper thermal effect than would be possible with prior art Rf needles.

The working end of the probe corresponding to the invention further provides a suitable cross-section and mass for maintaining heat. Thus, when the medial variable conductive matrix is elevated in temperature to its switching range, the conductive matrix can effectively function as a resistive electrode to thereafter passively conduct thermal energy to the engaged tissue volume. Thus, in operation, the working end can automatically modulate the application of energy to tissue between *active* Rf heating and *passive* conductive heating of the targeted tissue to maintain the targeted temperature level.

The working end of the probe can be have the form of a needle for piercing into tissue, and applicator surface for contacting a tissue surface or at least one surface of a jaw structure for clamping against tissue. The working end of the probe further can comprise a plurality of energy delivery members, operating in a mono-polar or bi-polar mode. In a further embodiment of the invention, the Rf treatment system can carry a fluid an infusion system for introducing an electrolyte to the engagement surface.

DESCRIPTION OF THE DRAWINGS

Other objects and advantages of the present invention will be understood by reference to the following detailed description of the invention when considered in combination with the accompanying Figures, in which like reference numerals are used to identify like elements throughout this disclosure.

FIG. 1A is a cross-sectional view of a *prior art* Rf needle apparatus illustrating its method of developing an active Rf current density in tissue at the initiation of energy delivery, further showing exemplary isotherms caused by such energy delivery.

FIG. 1B is a cross-sectional view of the a *prior art* Rf needle of FIG. 1A after an arbitrary time interval showing reduced current density in tissue, further showing exemplary isotherms that result from increased tissue impedance about the needle.

FIG. 2 is a plan view of an exemplary Type "A" probe in accordance with the invention.

FIG. 3 is an enlarged view of the working end of the Type "A" probe of FIG. 2.

FIG. 4 is a sectional view of a tissue mass and a tumor with the working end of the probe of FIG. 2 positioned therein.

FIG. 5 is a sectional view the working end of the probe of FIG. 3 taken along line 5-5 of FIG. 3 showing the components of the energy delivery member.

FIG. 6 is a graph of the temperature vs. resistance profile of the positive temperature coefficient material of the energy delivery member of FIG. 5.

FIG. 7A is a sectional view of a tissue mass and a tumor with the working end of the probe of FIG. 2 positioned therein.

FIG. 7B is a sectional view of a tissue mass similar to FIG. 7A showing isotherms in the method of treatment with the probe of FIGS. 1-5.

FIG. 7C is a graph showing the temperature-resistance profile of the medial conductive layer of the probe of FIGS. 1-5.

FIG. 8 is a schematic view of a Type "B" probe in accordance with the invention with a positive temperature coefficient conductive material that is flexible or compressible and illustrated in a probe having a plurality of energy delivery members that can be deployed on opposing side of a targeted tissue.

FIG. 9 is a sectional view of a portion of one of the energy delivery members of the probe of FIG. 8 taken along line 9-9 of FIG. 8 rotated 90° showing the component portions thereof.

FIG. 10A is an enlarged sectional view of the working end of the probe of FIG. 8 illustrating the connection of multiple engagement planes to an RF source and controller.

FIG. 10B is view of an alternative embodiment of the working end of the probe of FIG. 8 illustrating a cutting electrode at a distal tip of the energy delivery member and saline inflow ports proximate to the engagement plane.

FIG. 11A is a sectional view of the working of an alternative Type "C" embodiment that illustrated an energy delivery member with a compressible engagement plane and underlying positive temperature coefficient conductive material in a pre-deployed position.

FIG. 11B is a sectional view of the probe of FIG. 11A illustrating the compressible engagement plane and underlying positive temperature coefficient conductive material in a deployed position.

FIG. 12 is a sectional view of an alternative Type "C" energy delivery member with a compressible engagement plane illustrating it use in engaging an irregular surface of an anatomic structure.

FIG. 13 is a sectional view of an alternative Type "C" energy delivery member with a compressible engagement plane illustrating it with a cooperating clamping mechanism.

FIG. 14 is a sectional view of a Type "C" probe that similar to the probe of FIG. 8 except for providing a bi-polar mode of operation.

FIG. 15A is a view of another embodiment of Type "C" probe having a linear configuration that carries spaced apart energy delivery surfaces to provide bi-polar modes of operation.

FIG. 15B is a cut-away view of the probe of FIGS. 15A illustrating the components of the plurality of independent energy delivery components and connection to an Rf source.

FIG. 16A is a view of another embodiment of Type "C" probe having a helical configuration that carries spaced apart energy delivery surfaces on opposing sides of a helical member to provide bi-polar modes of operation.

FIG. 16B is an enlarged view of a portion of the probe of FIG. 16A illustrating the electrical field and localized energy density that can be created across the center portion of a helical member.